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KEY TO THE GENERA OF VALERIANACEAE

- Calyx inrolled in flower, developing in fruit to form a conspicuous pappus with 5–15 plumose awns; fruit 1-locular; plant perennial. 1. *Valeriana*.
 Calyx obsolete; fruit 3-locular; plant annual or biennial. 2. *Valerianella*.

1. *Valeriana* Linnaeus, Sp. Pl. 1: 31. 1753; Gen. Pl. ed. 5. 19. 1754.

Perennial herbs or vines with thickened, strong-scented, fleshy [woody or tuberous] roots, sometimes stoloniferous; glabrous or sparsely hairy with short, simple hairs. Leaves petiolate to nearly sessile, basal and cauline, undivided, pinnate, pinnatifid, or ternate. Inflorescence usually a dichasial cyme or thyrse, terminal or axillary, sometimes lax or subcapitate, bracteate and bracteolate. Flowers irregular, bisexual or uni-

sexual. Calyx inrolled in flower, enlarging and developing in fruit to form a pappus with short, sessile, patelliform, membranaceous limb and 5-15 plumose awns [or the limb cupuliform and irregularly dentate]. Corolla funnelliform or campanulate [salverform or rotate], the tube slightly saccate at the base [or straight], usually more or less hairy in the throat. 5[3 or 4]-lobed. Stamens 3 [rarely 4], inserted toward the top of the corolla tube, usually exserted (but included in *V. scandens*); anthers 2- or 4-lobed. Stigma simple or 3-lobed; ovary 3-locular, with two locules suppressed and one fertile with a solitary ovule. Fruit a unilocular, compressed achene with 3 nerves on the outer and 1 on the inner surface. LECTOTYPE SPECIES: *Valeriana pyrenaica* L.; see Britton & Brown, Illus. Fl. No. U. S. ed. 2. 3: 284. 1913. (Name Medieval Latin, from *valere*, to be strong; said also to be named for the Roman emperor Valerianus).

A genus of about 300 species of Europe, Asia, Africa, and America, centered mainly in the temperate regions of the Northern Hemisphere and the mountains of South America; eleven species in the United States, two in our area.

Of the seven sections recognized by Höck, six (*Pseudiastrephia* Höck, *Hybocarpus* Höck, *Valerianopsis* Wedd., *Phyllactis* Pers., *Porteria* Hook., and *Aretiastrum* DC.) are entirely South American and have been variously treated by different authors as distinct genera or as sections within *Valeriana*. The North American species belong to sect. VALERIANA (§ *Euvaleriana* Höck). Different authors have recognized a varying number of series within this section (cf. Höck, Meyer).

The genus is well defined by the combination of perennial habit, three stamens, and inrolled calyx usually enlarging and forming a pappus on the one-locular fruit. It is probably most closely related to *Valerianella* and to *Centranthus*, which is distinguished by one stamen and spurred corolla.

Valeriana scandens L., readily recognized by its climbing habit, occurs in Mexico, Central and South America, and the West Indies, northward in peninsular Florida to a shell-mound in Duval County. It seems likely that this species is a calciphile, but it does not appear to occur on the Florida Keys. It is placed by Meyer in the *Sorbifoliae*, a series distinguished chiefly by included stamens and two-lobed anthers. Meyer recognizes two varieties (which some authors have treated as distinct species): var. *scandens*, with tripartite leaves, and var. *Candolleana* (Gard.) Muell., with entire leaves. The widespread var. *scandens* occurs in Florida, but var. *Candolleana* occurs northward only to Hispaniola and Cuba. Intermediate specimens with both entire and tripartite leaves have been found, however, both in our area and elsewhere. *Valeriana pauciflora* Michx., distinguished by its long, funnelliform corolla tube and stoloniferous habit, occurs from Pennsylvania to Illinois, Tennessee, and Virginia. It is placed in the series *Officinales* Höck, separated by the rhizomatous or stoloniferous roots and four-lobed anthers.

Sexual polymorphism occurs in the genus in several ways, the plants being completely hermaphrodite, polygamous, polygamodioecious, or dioecious, with dioecism least common. The presence of unisexual as well as bisexual flowers is easily detected by the differential lengths of the corolla.

The mode of pollination appears to be unknown but is probably entomophilous. Nectaries are reported to occur in the saccate base of the corolla tube. The occurrence of proterandry assures cross-pollination in bisexual flowers.

The cytogenetics of *Valeriana officinalis*, $2n = 14, 28, 56$, has been extensively investigated, but the cytology of the genus as a whole is not well known. Chromosome numbers of $2n = 14, 16, 18, 28, 32, 56$, and 64 have been reported.

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2. *Valerianella* Miller, Gard. Dict. Abr. ed. 4. 1754.

Small annual or biennial, glabrous or pubescent herbs with dichasial branching, appearing dichotomous, but the terminal bud aborting in the lower branches. Basal leaves forming a rosette, petiolate to nearly sessile, undivided or dentate; cauline leaves connate, undivided, dentate [or rarely

incised-pinnatifid]. Inflorescence capitate, terminal, usually a dichasial cyme subtended by lanceolate to oblong, connate bracts. Flowers almost regular, bisexual [or unisexual] in the axils of lanceolate to oblong, connate bracteoles. Calyx obsolete [or forming a narrow, toothed rim]. Corolla funnellform, narrowly campanulate or tubular, the tube slightly saccate at the base, 5-lobed. Stamens 3, inserted toward the top of the corolla tube, exerted, anthers 4-lobed. Stigma simple or shortly 3-lobed; ovary 3-locular, one locule fertile with a solitary ovule. Fruit glabrous or pubescent, 3-locular, two of the locules empty, the other 1-seeded. LECTOTYPE SPECIES: *Valeriana Locusta* L. = *Valerianella Locusta* (L.) Betcke; see Britton & Brown, Illus. Fl. No. U. S. ed. 2. 3: 286. 1913. (Name a diminutive of *Valeriana*.)

A genus of temperate parts of the Northern Hemisphere, including about 60 species in two sections; 19 in North America, ten in our area.

The shape, relative size of the sterile locules, and indumentum of the fruits are the most important characters used to distinguish the species. The indumentum of the plant and the shape of the bracts (rounded, pointed, or acuminate) are also important characters. Specimens with both fruit and flowers are necessary for the determination of species.

Four species of sect. SIPHONELLA Krok, marked by salverform corollas and strongly glandular fimbriate-serrulate bracts, occur in the southeastern United States. *Valerianella Bushii* Dyal and *V. ozarkana* Dyal are strictly calciphile and known only from Arkansas and Missouri, while *V. Nuttallii* (Torr. & Gray) Walp. and *V. longiflora* (Torr. & Gray) Walp. are known only from western Arkansas and eastern Oklahoma. The other six species of our area belong to sect. VALERIANELLA, with funnellform corolla and glabrous bracts with entire or ciliate margins. *Valerianella Locusta* (L.) Betcke (*V. olitoria* (L.) Poll., *Valeriana Locusta* L. a *olitoria* L.), $2n = 14$, an introduced European species widely scattered throughout our area, is readily recognized by the corky mass on the fertile locule of the fruit. *Valerianella umbilicata* (Sulliv.) Wood and *V. patellaria* (Sulliv.) Wood occur from North Carolina and Tennessee, northward to New York, Ohio, and Illinois. They are distinguished from the other species in the section by the breadth of the sterile locules in comparison with the fertile locule of the fruit. *Valerianella intermedia* Dyal, which ranges from Massachusetts to Kentucky and Illinois, occurs in scattered localities in North and South Carolina, apparently as an introduction. It is closely related to *V. radiata* (L.) Dufr., a widespread, polymorphic species occurring throughout our area and extending to Pennsylvania, Kansas, and Texas. *Valerianella Palmeri* Dyal, occurring only in Arkansas, appears to be closely related to *V. intermedia* but is separated by its longer fruit with abortive sterile locules.

Some authors have thrown doubt on the validity of some of the species recognized in North America. Dempster has found dimorphism in the fruits of species of the closely related *Plectritis* and has revised the taxono-

my of that genus. In view of this, the species pairs *Valerianella Bushii*-*V. ozarkana* and *V. umblicata*-*V. patellaria* need further investigation, for in each pair the two sometimes grow together, show a similar, limited geographical distribution, and are distinguished by their fruits.

There is a lack of cytological information relating to North American species of *Valerianella*. Chromosome numbers of $2n = 14, 16, 18, 32$ have been reported for European and Asiatic species. The method of pollination appears to be unknown; insect visitors have been observed and self-pollination reported to occur.

Valerianella has affinities with *Valeriana*. It is very closely related to *Fedia* and *Plectritis*, and early authors treated these variously as one or more genera. More recent authors have treated *Fedia* as a monotypic Mediterranean genus distinguished by its irregular corolla, two stamens, and dimorphic fruits. *Valerianella* is separated from the predominantly western North American *Plectritis* by the typically 3-locular ovary, 3-lobed stigma, and dichotomously branched inflorescence *vs.* the 1-locular ovary, 2-lobed stigma, and capitate or interruptedly spicate inflorescence.

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DIPSACACEAE A. L. de Jussieu, Gen. Pl. 194. 1789, "Dipsaceae," nom. cons.
(TEASEL FAMILY)

Mostly perennial herbs, the flowers bisexual, irregular, with a calyx-like involucl of fused bracteoles, and borne in the axils of imbricate receptacular bracts, the calyx small [variable], the corolla gamopetalous, 4[5]-lobed, the stamens 4 [5], inserted toward the top of the corolla tube, and the ovary inferior. TYPE GENUS: *Dipsacus* L.

An Old World family of about eight to twelve genera and 250-300 species, centered in the Mediterranean and Near East, extending to North Europe, East Asia, and South Africa. About ten species in the genera *Dipsacus*, *Cephalaria*, *Scabiosa*, *Knautia*, and *Succisa* are naturalized in North America; one species of *Dipsacus* occurs in our area.

Dipsacaceae are placed in the Rubiales by most authors and appear to be a very natural family, with the exception of the isolated genus *Morina*, which some authors have placed in a separate family. Dipsacaceae have close affinities with Valerianaceae. The family is distinguished from Valerianaceae by the unilocular ovary and by the capitate inflorescence surrounded by an involucre of bracts, characters which suggest affinities with Compositae.

Chromosome numbers of $2n = 10, 14, 16, 18, 20, 34, 36, 38, 42, 43, 44, 46, 50, 54,$ and 64 have been reported. Ehrendorfer has suggested that the basic chromosome number of the family is $x = 9$ and that euploidy, aneuploidy on the diploid level, polyploidy followed by aneuploidy, gene-, chromosome-, and genome-mutations have been important in the evolution of Dipsacaceae.

The variation in the receptacular bracts and the diverse development of the involucl and calyx are connected with fruit dispersal and give good characters for taxonomic division of the family into genera.

The family is of little economic importance. A few genera are of horticultural interest, and *Scabiosa* is widely cultivated for its ornamental value.

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1. *Dipsacus* Linnaeus, Sp. Pl. 1: 97. 1753; Gen. Pl. ed. 5. 43. 1754.

Stout, erect, biennial herbs with spiny or prickly stems. Leaves simple, entire [to pinnately divided], opposite, exstipulate; basal leaves petiolate, stem leaves connate [petiolate]. Inflorescence a head with 1 or 2 rows of

linear to lanceolate [narrowly triangular], subulate, erect or spreading, spine-tipped involucre bracts; each flower subtended by a chaffy receptacular bract and surrounded by a 4-angled tubular involucre of fused bracteoles, which is grooved with a median rib and truncate at the apex, with an almost obsolete denticulate margin. Calyx cup-shaped, 4-angled, with a ciliate margin. Corolla imbricate, lobes often unequal. Stamens 4, alternate with the corolla lobes, exerted; filaments free; anthers 4-locular, introrse, longitudinally dehiscent; pollen tricolpate, echinate. Stigma lateral, entire; style filiform; ovary unilocular, ovule solitary, anatropous, pendulous from the apex of the locule. Fruit indehiscent, dry, inclosed within the calyx-like involucre and crowned with the persistent calyx. Seed 1; endosperm fleshy; embryo straight, the cotyledons oblong or ovate, the radicle superior. Embryo sac development of the normal (*Polygonum*) type. LECTOTYPE SPECIES: *D. fullonum* L.; see Britton & Brown, Illus. Fl. No. U. S. ed. 2. 3: 289. 1913. (Name from Greek, *dipsa*, thirst, because the united cup-shaped bases of the leaves in some species hold water.) — TEASEL.

About 12 species of Europe, western Asia, and Africa, three naturalized in North America. *Dipsacus fullonum* L. (*D. sylvestris* Huds.),² $2n = 16, 18$, a native of Europe, is probably widespread and scattered throughout the United States, occurring sporadically in our area. *Dipsacus fullonum* has close affinities with *D. sativus* (L.) Schkuhr (*D. fullonum* auct. non L.), $2n = 16, 18$, also a native of Europe, locally naturalized in the northeastern United States. The involucre bracts curve upward in *D. fullonum* and the receptacular bracts end in a long straight spine, while in *D. sativus* the involucre bracts spread more or less horizontally and the receptacular bracts end in a stiff, recurved spine. Some authors have treated *D. sativus* as a subspecies of *D. fullonum*. The very different laciniate-leaved *D. laciniatus* L. is established in the northeastern United States.

The genus is mainly a well-defined one recognized by the presence of stem prickles and spine-tipped bracts. It is most closely related to *Cephalaria*, which is also distinguished from the rest of the family by chaffy receptacular bracts and a four-angled involucre. Grenier and Godron placed *D. pilosus* L. in *Cephalaria*, but few subsequent authors have adopted this treatment.

The mode of flowering in the genus is characteristic, the flowers opening first about halfway up the head and developing in sequence both upward and downward.

The species are separated on the basis of the leaves, which may be connate or stalked, entire or divided; the inflorescence, which may be oblong, ovate, or globose; and the involucre bracts, which may be linear-lanceolate, subulate, keeled with spines on the margins and midrib, or narrowly triangular, shorter or longer than the inflorescence.

²The application of the name *Dipsacus fullonum* L. will be discussed in the next issue of this Journal.

The ripened inflorescences of *D. sativus*, the fuller's teasel, are used in fulling cloth (raising the nap), and the plants are grown to a limited extent for this purpose.

The flora and fauna of the rain water caught by the connate leaf bases have been studied more or less extensively, but most biological aspects of the genus have been neglected.

Chromosome numbers of $2n = 16, 18, 36$ have been reported.

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ARNOLD ARBORETUM
AND
GRAY HERBARIUM

A PRELIMINARY REPORT ON FUNIFERA

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THE EARLIEST RECORDED INFORMATION concerning the plants now recognized as members of the thymelaeaceous genus *Funifera* C. A. Mey. was published in 1820 (Atti Soc. Ital. Sci. Modena 18: 391), by the Italian botanist Raddi. In that publication, by means of a rather sophisticated and complete description, Raddi defined a new Brazilian species of *Daphne*, *D. brasiliensis* (to be transferred below to *Funifera*). In nearly a century and a half which has since elapsed, our knowledge of this and related species has not increased much; the chief contribution being descriptions of a few additional species.

At the suggestion of Mr. Guido Pabst, Director of Herbarium Bradeanum, I started what was intended to be a comprehensive revision of the genus *Funifera*. However, the poor quality of most of the existing collections (i.e., flowers and fruits lacking from most of the sheets) has frustrated such a project. I hoped the difficulties would be at least partially overcome when I had a large suite of specimens assembled. Since, however, the additional material was not very satisfactory I am presenting as a report the information now available, hoping it may serve as an outline for field work and eventual new collections which will make possible a precise and detailed study.

The species of the genus *Funifera* are not conspicuous components of the vegetation in the areas of Brazil where they grow; nor are they of great economic importance even at the local level. They are intriguing because so little is known of their geographic and ecologic distribution, their anatomy, and their morphology. In addition, the medicinal potential of these plants found in references from folk-medicine, has both practical and theoretical application in modern phytochemistry.

Various properties attributed to plants of the genus *Funifera* are similar to those ascribed to other genera of the Thymelaeaceae. The tough cortical fibers of *Funifera* are employed as cordage (Penna, 1946) a common practice in related genera of the family throughout the geographic distribution. The fibers of the American genera are never used in paper making, this use being restricted entirely to the Old World members of the family. A decoction of the macerated bark of *Funifera* is used externally as a vesicant (Dragendorff, p. 204. 1898) in the same manner as that of *Daphne mezereum* L. of Europe. If accidentally ingested the decoction is especially caustic to the mucous membrane of the mouth. Other American Thymelaeaceae known to have a similar vesicating effect are *Daphnopsis* (one species has the common name "Burn Nose"), *Dirca*, and *Ovidia*.

A decoction of the leaves of *Funifera* may be used internally as an

emetic or cathartic according to Hoehne (pp. 204, 205. 1939). Similar results may be obtained also from the New World genera *Daphnopsis*, *Dirca*, *Lagetta*, *Lasiadenia*, and *Ovidia*. Based on a very limited number of reports, in *Daphnopsis*, *Dirca*, and *Ovidia*, such a decoction, or the comparable use of fruits, should be avoided as it presents more than a little danger to the patient (both violent illness and death have been reported). Hoehne (p. 206. 1920) says that *Funifera* is "extremamente toxicas." He further notes that cattle are adversely affected by grazing both *Daphnopsis* and *Funifera* and are stricken particularly from May to September (during the vegetative growth phase).

An active principle has not been isolated but several compounds, mezerein, daphnin, and umbelliferone, have been reported in several genera of the Thymelaeaceae. Hoehne (p. 206. 1920; p. 204. 1939) has reported both mezerein and daphnin present in *Funifera*. If these compounds, or chemically related ones, are more consistently present in the family than has been realized, they may provide the chemical basis for the similarity of application found in folk medicine throughout the world. The chemical composition of mezerein is unknown, most authorities referring it to the category of an "acrid resin." Both umbelliferone and daphnin belong to a large group of related compounds having coumarin (for a most informative paper on this compound see Brown, 1963) as a nucleus. Since the coumarin derivatives are found in many groups of plants their use as supplemental taxonomic characters is less important than might have been expected. Umbelliferone is known to absorb ultraviolet light and has been used as sunburn protection, and as a whitening agent in soap powders. Specific uses for daphnin have not been reported. Coumarin has been used commercially as an adulterant or substitute for vanilla, as an adulterant of tobacco, and in the perfume trade. It has a fragrant odor and burning taste. A coumarin derivative could account, in part, for the peculiar and distinctive odor of many thymelaeaceous plants. In general, coumarin is considered nontoxic to mammals although Pammel (p. 552) points out that "Dr. Millspaugh states that in large doses, [it] causes nausea, vomiting, vertigo, great depression of the heart's action and cold extremities." Dean (p. 241) further states that . . . "larger animals (e.g., dogs, horses) can be killed by coumarin, but moderate quantities have no very marked effect on man except that it has been reported recently that coumarin has a true curare-like activity." It is impossible to say whether a single compound or a group of compounds is responsible for the similarity of medicinal uses to which thymelaeaceous plants are put but the latter alternative seems more likely. It is clear that more precise diagnostic and physiological data are needed for all the compounds mentioned.

MATERIALS

This study is based on specimens from the following herbaria, the abbreviations for which are taken from Lanjouw & Stafleu's *Index Herbariorum*, Part I. Ed. 5 (Regnum Vegetabile, 31. 1964).